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HYGIENE;
DETERMINANTS AND ITS IMPACT ON DIARRHEA

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ABSTRACT... Background: Hygiene is very important aspect of health, it helps prevent many diseases. According to WHO, 25% admission to hospitals are due food and water borne diseases which can be prevented through good hygiene practices. **Objectives:** To check the hygiene status and practices of rural farmer and non-farmer households and to examine the determinants of hygiene status. Association between hygiene and diarrhea was also examined in this study. **Study design:** Cross sectional study. **Research Area:** Farmer and non-farmer rural households of Punjab. **Period:** April 2016 to January 2017. **Material and Methods:** probability sampling technique was used and a total of 576 households (50% farmer and 50% non-farmer) were surveyed from six districts of Punjab. Responses were obtained using a structured interview scheduled. SPSS version 24 was used for analysis. **Results:** Mean age for farmer and non-farmer households was about 50 and 47 years respectively. Mean number of schooling years for farmer and non-farmer households were 6.2 and 5.1 respectively. Average monthly income of farmer and non-farmer households was 24728 and 16432 PKR respectively. About 18% farmer and 27% non-farmer households had low hygiene status. About 11% farmer and 25% non-farmer households did not have any toilet. About 19% farmer and 24% non-farmer households reported that they had diarrhea at least once in last 6 months. Association between diarrhea and hygiene was found significant at $p<0.01$. Income and education were important determinants of hygiene status for both farmer and non-farmer households. **Conclusion:** Authors conclude that hygiene status varies for farmer and non-farmer households that can be explained by the difference in income, education and awareness. It was empirically established that better hygiene helps prevent diarrhea.

Key words: Hygiene, Diarrhea, Rural Households.

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INTRODUCTION

Food hygiene is very essential for good health. WHO[1] defined food hygiene as "measures and conditions that are necessary for safety of food from its production to consumption". Food can be contaminated at any point during harvesting or slaughtering, processing, distribution, storage and consumption. Contaminated food can cause many foodborne diseases and even death of consumers.

Food Hygiene and Diarrhea

Results of the studies show that food is also an important way of transmission of diarrhea in developing countries.[2-4] Out of 1.5 million deaths related to diarrhea in 2012, it is estimated that 842,000 were caused by inadequate water, sanitation, and hygiene.[5] Hygiene alone is estimated to reduce diarrhea morbidity by up to 45%.[6] World Health Organization (WHO) data indicated that food and waterborne diarrheal disease cause death of approximately 2 million people every year.[7] Diarrheal disease is the primary cause of illness around the world, especially in developing countries. Epidemiological data show that food play a vital role in transmitting micro-organisms that cause diarrheal disease.[8] It is estimated that micro-organisms transmitted through food are responsible for about 70% of diarrheal episodes among children.[9,10] This is due to the amount of bacteria present in contaminated food, when it is kept at room temperature for long periods, is higher than that in water. Food provides conducive environment for exponential

bacterial growth, whereas bacterial pathogens can survive only for short period of time but they cannot grow significantly when there are no other nutrients.[2,3]

According to WHO[11] diarrheal disease can potentially decrease by 28 percent with improvement of sanitation facilities; decrease by 45 percent with water treatment at the household level (for example boiling water or using chlorine or other suitable agents) and improving water storage; and decrease 23 percent by washing hands with soap. Proper food hygiene practices have been reported to reduce diarrhea risk by 33 percent.[12] This figure may be higher because, as noted earlier, up to 70 percent of diarrheal episodes among children could be due to pathogens ingested through food. Food hygiene practices, like thorough cooking, storing food at appropriate temperatures, and washing hands with soap before food preparation play a vital role in preventing the transmission of diarrheal diseases regardless of the source of pathogens.

Components of Hygiene

Access to safe drinking-water, sanitation and hygiene (WASH) services is a basic component of a healthy community and has a significant positive impact on nutrition.

Water

Availability of and accessibility to safe drinking water is vital for food hygiene. Unsafe drinking water causes can increase in the morbidity burden of hepatitis and other water borne diseases. The rural population that does not have access to safe drinking water is more than five times greater than that of the urban population. This difference is clearly evident in sub-Saharan Africa, and also significant in South Asia and Latin America.[13] Approximately 663 million people around the world do not have access to source of improved drinking water.[14], and approximately 1.9 billion people use fecally contaminated drinking-water.[15]

In Pakistan, like many developing countries, access to safe drinking water has improved i.e. from 86.3% in 1990 to 91.4% in 2015 (Figure 1.4), still 16.2 million people do not have access to safe drinking water which make them vulnerable to many water and food borne diseases.

Sanitation

Sanitation normally means the providing facilities and services to safely dispose human urine and feces. Approximately 2.4 billion people (one third of the world's population) do not have access to an improved sanitation facility, and 13% of the world's population still practice open defecation. Among the world's regions, sub-Saharan Africa and South Asia have the lowest sanitation coverage.[16]

Access to better sanitation facilities is even less than safe drinking water in Pakistan. Figure 1.5 shows that although, Pakistan has made progress in providing improved sanitation facilities to its population i.e. 23.7% in 1990 to 63.5% in 2015, still 68.7 million people have either no or poor access to improved sanitation facilities.[17]

Hygiene

It includes the practices of washing hands after defecation with soap and disposing child feces before handling and preparing food and before eating. Hygiene also means the practices of food hygiene (handling, preparation, storage and serving) and environmental hygiene like safe disposal of solid waste.[18] A systematic review of 42 studies in 19 countries conducted on observed hand washing with soap revealed that only 19 percent of people around the world wash their hands with soap after contact with excreta.[19]

In Pakistan, 46% population does not have handwashing facility and soap at home. Among these households, 56% are from rural areas and 26% are from urban areas.[14] Only 23% households have garbage collection system, out of which 17% is covered by municipality and 7% is covered by private garbage collectors.[20]

The objective of this research was to check the hygiene status and practices of rural farmer and non-farmer households and to examine the determinants of hygiene status. Association between hygiene and diarrhea was also examined in this study.

MATERIAL AND METHODS

The study was designed to measure hygiene conditions of farmer and non-farmer households of the Punjab. A cross-sectional research method (survey) was used to explore the objectives of the study.

This study was conducted in Punjab. The study area was based on 6 districts in total and 2 districts from each region. Six districts were selected randomly. One Tehsil was selected from each selected district and then four villages were selected from each Tehsil randomly. On average, every village in Pakistan has about 200 households in which majority (>80%) are either small farmer or non-farmer households (GOP, 2010). Survey data for this study were gathered from about 12% (i.e. 6% farmer and 6% non-farmer) of these households. It means, 12 farmer and 12 non-farmer households were selected from each village randomly which made an overall sample of 576 households. A structured interview schedule was developed to gather information on different facets of hygiene. An index was created containing 4 components (i.e. water, food, personal and household hygiene) to measure hygiene. Index had a total of 24 questions with two possible responses (1=yes or 0=no). highest possible score was 16 which was then divided into three categories i.e. Low, Medium and High. Internal reliability of the questions included in index as measured by Cronbach's alpha was high (0.86).

RESULTS

Table-I shows that 68% farmer and about 76% non-farmer household heads had age up to 55 years representing the active age group. While, about 32% farmer and about 24% non-farmer household heads were aged over 55 years. About 44% famer and about half of the non-farmer households had up to 6 members, 25% farmer and about 20% non-farmer households had 7 to 8 members. While, remaining, about 32 and 30% farmer and non-farmer households, respectively, had more than 8 members. About 41% farmer and 51% non-farmer households had only 1 earning member. About 32% farmer and 23% non-farmer households had 2 earning members. While, about 28% farmer and 26% non-farmer households had more than 2 earning members. More than half (about 51% farmer and 58% non-farmer) households had joint family structure. More than one third (about 37%) farmer and a little less than half (about 47%) non-farmer households were illiterate.

Variables	Farmer f (%)	Non-farmer f (%)	Total f (%)
Age			
Up to 35	42 (14.5)	64 (22.2)	106 (18.4)
36-55	154 (53.5)	156 (54.1)	310 (53.8)
>55	92 (31.9)	68 (23.7)	160 (27.7)
Family Size			
Up to 4	41 (14.2)	45 (15.6)	86 (14.9)
5-6	85 (29.5)	100 (34.7)	185 (32.1)
7-8	69 (25.0)	58 (20.1)	127 (22.0)
9-10	45 (15.6)	49 (17.0)	94 (16.3)
>10	48 (16.70	36 (12.5)	84 (14.4)
Earning Members			
1	117 (40.6)	146 (50.7)	263 (45.7)
2	91 (31.6)	66 (22.9)	157 (27.3)
3	48 (16.7)	45 (15.6)	93 (16.1)
>3	32 (11.1)	31 (10.8)	63 (10.9)
Family Structure			
Nuclear	142 (49.3)	121 (42.0)	263 (45.7)
Joint	146 (50.7)	167 (58.0)	313 (54.3)
Education of HH			
Illiterate	105 (36.5)	134 (46.5)	239 (41.5)
Primary	33 (11.5)	53 (18.4)	86 (14.9)
Middle	45 (15.6)	32 (11.1)	77 (13.4)
Matric	69 (24.0)	36 (12.5)	105 (18.2)
Intermediate +	36(12.5)	33 (11.5)	69 (12.0)

Table-I. Demographic characteristics of the respondents

Table-II shows the observed and self-reported results of different hygiene indicators. It is clear from the data that farmer households performed better on every hygiene indicator as compared to non-farmer households. Washing cooking utensils before use (92.7% for farmer and 87.1% for non-farmer HHs), covering cooked food (96.2% for farmer and 92.7% for non-farmer HHs), showering at least twice a week (93.1% for farmer and 90.6% for non-farmer HHs) and washing hands before cooking/feeding children (89.9% for farmer and 86.1% for non-farmer HHs) were most practiced indicators. In a study in Bangladesh, Nizame, Unicomb[21] reported that 46% of the respondents feed their children without washing hands with soap and 38% touch the food with dirty hands. As the study participants belonged to less privileged section of society, some households had shared toilets with neighbors and many households did not have any toilet at all and practice open defecation (30.6% for farmer and 38.2% for non-farmer HHs). Through open defecation, human feces may end up in food chain and can cause multiple health problems including diarrhea. Safe disposal of babies' feces was among least practiced (68.1% for farmer and 62.5% for non-farmer HHs) which also threatens health status of household members as bacteria and worms in the feces may come in contact with food.

Observations	Farmer		Non-farmer	
	f	%	f	%
Clean dishes covered	237	82.3	219	76.0
Clean dishes kept high	231	80.2	217	75.3
Cooking utensils washed before use	267	92.7	251	87.1
Food covered after cooking	277	96.2	267	92.7
Raw and cooked food kept separate	237	82.3	214	74.3
Hands washed before cooking	259	89.9	248	86.1
Hands washed before eating	243	84.4	239	83.0
HH members wear shoes	252	87.5	223	77.4
HH members' hands are clean	232	80.6	221	76.7
HH members' cloths are clean	214	74.3	185	64.2
Everyone in HH use toilet	232	80.6	195	67.7
Practice open defecation	88	30.6	110	38.2
Babies' feces disposed safely	196	68.1	180	62.5
Wash hands after restroom	262	91.0	229	79.5
Shower at least twice a week	268	93.1	261	90.6
Trash outside house	212	73.6	227	78.8
Trash inside house	68	23.6	86	29.9
Unrestrained animal in the house	77	26.7	80	27.8
Stationary water inside house	51	17.7	62	21.5
Stationary water outside house	98	34.0	120	41.7
Waste depository near house	173	60.1	199	69.1
Drink untreated ground water	33	11.5	43	14.9
Water storage container covered	158	54.9	63	21.9
Exterior of water container clean	193	67.0	157	54.5

Table-II. Frequency distribution of the respondents according to their hygiene behavior

In hygiene research, handwashing before and after different occasions is the most researched issue.[21-26] Sherwani, Bashir[25] in their study regarding knowledge, attitude and practices of handwashing in Karachi, Pakistan, reported that only 40% of the respondents wash their hands frequently, 50% use towel to dry their hands and about 35% use shared towel. A study by Mutalib, Azira[27] found that about 40% of the food handlers disagreed or were uncertain about keeping raw and cooked food separately.

Data in Table-III show the hygiene categories. These categories were calculated from the sum

of hygiene index score. It was found that farmer households had better hygiene status than non-farmers. About 18% farmer and 27% non-farmer households had low hygiene status, 42% farmer and about 40% non-farmer households had medium level of hygiene. About 40% farmer and about 34% non-farmer households had high level of hygiene. It is also clear from the findings that overall condition of hygiene was not satisfactory for both farmer and non-farmer households.

Hygiene Level	Farmer		Non-farmer	
	f	%	f	%
Low	52	18.1	79	27.4
Medium	121	42	112	38.9
High	115	39.9	97	33.7

Table-III. Frequency distribution of respondents according to their hygiene level

Availability of Toilets

Availability of toilets is very important for good hygiene, without the availability of toilets, people have to defecate in open which has consequences for human health. Results in Table-IV.14 show that about 11% farmer and about one fourth (25.3%) non-farmer households did not have toilet. They either have to defecate in open or have to use shared toilet with their neighbors. A little more than half i.e. 52.1% farmer and 53.1% non-farmer households had only one toilet available for all the members of the household. About 29% farmer and about 16% non-farmer households had two toilets. Not a single public toilet was seen in 24 villages and their adjacent areas included in this study. Toilets at school were reported to be in dire condition by some of the respondents.

No. of Toilets	Farmer (n=288)		Non-farmer (n=288)	
	f	%	f	%
0	32	11.1	73	25.3
1	150	52.1	153	53.1
2	84	29.2	45	15.6
>2	22	7.6	17	5.8

Table-IV. Availability of toilets

Waste Water Disposal

As mentioned earlier, proper sanitation is very important component of hygiene. Safe disposal of both water and solid waste reduces the chances of water and food borne diseases.

Data in Table-V show that majority of both type of households (about 65% farmer and about 67% non-farmer) were disposing their waste water in Naali (an open sewer line). Underground sewer system was not available in any of the village included in this study. 24% farmer and about 20% non-farmer households were disposing their waste water in Khui (a dug well) which has adverse effects on ground water of that area. Ground water contamination with human feces has many implications for human health causing a number of diseases. About 4% farmer and about 7% non-farmer households were disposing their waste water in the street and it was not only grey water, black water was also disposed into streets. Young children were seen to make contact with this water while playing and they were vulnerable to diarrhea and other communicable diseases. About 4% farmer and 2.4% non-farmer households were disposing their waste water in water courses (water channels for agricultural purpose). This contaminated water was used to irrigate the crops including vegetables and other crops. Food grown with contaminated water is not safe at all and people are vulnerable to get diseases instead of nutrients from such grown food. About 4% farmer and 11% non-farmer households were disposing their waste water directly into agricultural fields which poses same threat for the people eating food grown in those fields. These results are in line with the findings of Mangi.[28]

Waste Water Disposal	Farmer (n=288)		Non-farmer (n=288)	
	F	%	f	%
Naali (an open sewer line)	187	64.9	192	66.7
Khui (a dug well)	69	24	57	19.8
Street	10	3.5	21	7.3
Water course (water channel for agricultural purpose)	11	3.8	7	2.4
Agricultural fields	11	3.8	11	3.8

Table-V. Waste water disposal

Solid Waste Disposal

Just like waste water, proper disposal of solid waste is also important in maintaining good hygiene and preventing diseases. Data in Table-VI show that majority of the households of both type (90.3% farmer and 87.8% non-farmer households) were disposing their solid waste in a nearby waste depository. These waste depositories were not taken care of, animals like goats and donkeys were seen feeding on them and when there was no space for more solid waste, these depositories were often set to fire to make room for more solid waste. Setting these depositories on fire deteriorates the air quality and cause respiratory problems. People are forced to throw their waste in these depositories because there was no waste management system in villages, only few adjacent to the cities had some sort of waste collection system. Only 4% farmer and about 8% non-farmer households were disposing their waste through waste collector. About 6% farmer and about 5% non-farmer households were just throwing their solid waste into the streets which again make people vulnerable to diseases and compromise the cleanliness.

Solid Waste Disposal	Farmer (n=288)		Non-farmer (n=288)	
	f	%	f	%
Waste collector	11	3.8	22	7.6
Waste depository	260	90.3	253	87.8
Thrown into street	17	5.9	13	4.5

Table-VI. Solid waste disposal

Hygiene score in relation to the household characteristics (ANOVA)

Hygiene depends on a number of household characteristics.[23,24,27] Relationships between hygiene practices and important household characteristics are presented below. Significance of the relationship is examined by using ANOVA and Chi-square test.

Hygiene in relation to household income

Table-VII shows the mean hygiene score for different income levels of farmer and non-farmer households. Households (both farmer and non-farmer) with higher income showed better score on hygiene index. Households in lowest income category (up to 20,000 PKR) had lowest hygiene score and the households in highest income category (>60,000 PKR) had highest hygiene score. It can be explained by the fact that households with higher income had access to media which is a major source of awareness regarding effects of poor hygiene behavior. Also, with higher income, households can easily afford toiletries and other necessary things for better hygiene. So, it can be said that higher income can lead to better hygiene behavior. To check if differences between groups are significant, one-way ANOVA was executed. Significant differences between groups were found at 1% level of significance.

Hygiene in relation to education of household head

Education has been found significantly related with hygiene status in previous studies.[29-31] With better education status, people become aware of the importance of hygiene for their health.

Table-VIII shows the mean of hygiene score for different levels of household head's education level. The households of which the household head has masters level of education showed

the best hygiene score for both farmer and non-farmer households. Households with illiterate household head showed the lowest hygiene score. These results can be explained the fact that educated household heads are aware of the importance of hygiene and they make sure that proper hygiene behavior is observed by every household member. So, it can be said that higher income can lead to better hygiene behavior. In order to check if differences between educational groups are significant, one-way ANOVA was used. Significant differences between groups were found at 1% level of significance.

Income	Hygiene score			
	Farmer (n=288)		Non-farmer (n=288)	
	Mean (SD)	95% CI	Mean (SD)	95% CI
Up to 20000	7.63 (4.43)	6.90 – 8.37	6.34 (4.54)	5.69 – 6.98
20001-40000	8.97 (3.35)	8.12 – 9.83	9.48 (4.05)	8.48 – 10.49
40001-60000	10.93 (2.95)	9.82 – 12.05	10.67 (4.24)	8.81 – 12.53
>60000	11.45 (3.96)	8.26 – 10.28	11.95 (3.28)	10.05 – 13.86
F-value	8.29**		19.5**	

Table-VII. Hygiene score in relation to Income
****significant at 1%**

Education	Hygiene score			
	Farmer (n=288)		Non-farmer (n=288)	
	Mean(SD)	95% CI	Mean(SD)	95% CI
Illiterate	7.54 (4.72)	6.63 – 8.46	5.40 (4.44)	4.64 – 6.16
Primary	8.79 (3.35)	7.74 – 9.83	8.32 (3.91)	7.28 – 9.35
Matric	9.69 (3.31)	9.11 – 10.27	10.41 (3.78)	9.54 – 11.27
Intermediate and above	11.07 (2.55)	9.66 – 12.48	12.67 (1.77)	11.86 – 13.47
F-value	7.644**		36.884**	

Table-VIII. Hygiene score in relation to education of household head
****significant at 1%**

Hygiene in Relation to Age of Household Head

Age and hygiene status of the household are also found significantly associated with each other.[32]

Table-IX shows the mean of hygiene score for age of household head. On average the households (both farmer and non-farmer) with older household heads scored higher than households with younger household heads. This finding can be explained by the fact that older household heads have more awareness regarding diseases caused by poor hygiene. So, they make sure that household members observe proper hygiene behavior in order to avoid the diseases caused by poor hygiene practices. In order to check if differences between age groups are significant, one-way ANOVA was used. Significant differences between groups were found at 5% level of significance.

Age of HH Head	Farmer (n=288)		Non-Farmer (n=288)	
	Mean (SD)	95%CI	Mean (SD)	95%CI
Up to 25	4.00 (4.18)	-1.19 – 9.19	4.62 (4.14)	1.16 (8.08)
26-35	7.94 (3.60)	6.75 – 9.14	8.11 (4.80)	6.82 (9.39)
36-45	8.61 (4.29)	7.60 – 9.62	7.64 (4.53)	6.63 (8.66)
46-55	9.11 (3.69)	8.30 – 9.92	8.58 (4.14)	7.64 (9.52)
>55	9.42 (3.98)	8.60 – 10.25	7.34 (5.43)	6.02 (8.65)
F-value	3.024*		1.687^{NS}	

Table IX. Hygiene score in relation to Age of HH head
***significant at 5%** **NS=non-significant**

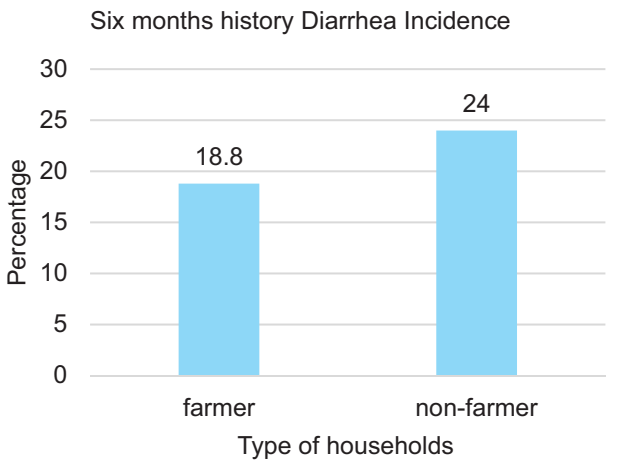

Figure-1. Six months record of diarrhea

It is clear from the figure 1 that 19% farmer and 24% non-farmer households reported that any of their household members had diarrhea in last 6 months.

Association Between Diarrhea and Hygiene Status

Table-X shows the association between incidence of diarrhea in last six months and hygiene status of the farmer and non-farmer households. About 35% of the farmer households whose members suffered from diarrhea at least once in last 6 six months had low level of hygiene. This percentage is greater than that of farmer HHs whose members suffered from diarrhea at least once in last 6 six months and have high level of hygiene (26.10%). About 13% of the farmer HHs whose members did not suffer from diarrhea in last six months had low hygiene level. While a greater percentage of farmer HHs whose members did not suffer from diarrhea belonged high hygiene group. This shows a significant association between prevalence of diarrhea among farmer HHs and their hygiene level.

The values of Pearson Chi-square (18.596), likelihood ratio (17.112), linear by linear association (15.885) and Gamma (0.419) confirm the significant association at 1% level of significance. The positive sign of Gamma is because the response to prevalence of diarrhea were coded as '1' for 'yes' and '2' for 'no'. This indicates that there higher the hygiene level of the respondents, lower is the prevalence of diarrhea for farmer households.

The table below also indicates that about 49% of the non-farmer HHs whose members suffered from diarrhea at least once in last 6 six months had low level of hygiene. This percentage is greater than that of non-farmer HHs whose members suffered from diarrhea at least once in last 6 six months and had high level of hygiene (19.20%). About 20% of the farmer HHs whose members did not suffer from diarrhea in last six months had low hygiene level. While a greater percentage of non-farmer HHs whose members did not suffer from diarrhea belonged high hygiene group (38.6%). This shows a significant association between prevalence of diarrhea among farmer HHs and their hygiene level.

The values of Pearson Chi-square (24.550), likelihood ratio (23.381), linear by linear association (21.284) and Gamma (0.481) confirm the significant association at 1% level of significance.

Diarrhea	Hygiene Status							
	Farmer (n=288)				Non-farmer (n=288)			
	Low	Medium	High	Total	Low	Medium	High	Total
Yes	24	27	18	69	36	23	14	73
	34.80%	39.10%	26.10%	100.00%	49.30%	31.50%	19.20%	100.00%
No	28	94	97	219	43	89	83	215
	12.80%	42.90%	44.30%	100.00%	20.00%	41.40%	38.60%	100.00%
Total	52	121	115	288	79	112	97	288
	18.10%	42.00%	39.90%	100.00%	27.40%	38.90%	33.70%	100.00%

Table-X. Association between diarrhea and hygiene status

Tests	Farmer			Non-farmer		
	Value	df	Significance	Value	df	Significance
Pearson Chi-square	18.596	2	.000	24.550	2	.000
Likelihood ratio	17.112	2	.000	23.381	2	.000
Linear by linear association	15.885	1	.000	21.248	1	.000
Gamma	0.419		.000	0.481		.000
Tests						

DISCUSSION

Results of the study show that farmer households had slightly better hygiene conditions than non-farmer households. This situation can be explained by the fact that sample households in this study belong to the poor segment of society with low socio-economic status. Schmidt, Aunger[23] reported that in Kenya, socio-economic status of the respondents and access to media were important determinant of their hygiene practices. Aunger, Schmidt[24] also found that economic status of the respondents was an important influencing factor in hand washing behavior.

In this study it was found that 11% farmer and 25% non-farmer households did not have access to toilets. Mahmood[33] reported that 41 million people in Pakistan do not have access to toilets and are forced to defecate in open that have many health and nutrition related issues. Consequences are worse for children; because of open defecation, children are not able to wash themselves properly and as a result bacterial contamination follows. It leads to long-lasting diarrhea and state of malabsorption in children. Such long-lasting malnutrition can also result in cognitive deficiencies and inadequate development of brain.

It was found that majority of both type of households (about 65% farmer and about 67% non-farmer) were disposing their waste water in Naali (an open sewer line). These results are in line with the report presented by Mangi.[28]

Income of the households was found to be significantly associated with hygiene status of the households. Households with higher income can better afford toiletries to ensure good personal and household hygiene. Schmidt, Aunger[23], Aunger, Schmidt[24] also found that socio-economic status of the study participants determined their hygiene and hand washing behavior.

Educational status of household head was also found significant element for hygiene. An educated household head can better educate his/her household's members regarding the importance of good hygiene behavior and Mutalib, Azira[27] in their study in Malaysia found that higher educational status of the respondents was associated with better hygiene practices of food handlers. A study by Schmidt, Aunger[23] found that education was positively and significantly associated with hygiene practices especially hand washing at $p<0.001$ which is in accordance with the findings of our study.

Age of household heads was significantly associated with hygiene status of the household. Older households are more aware of the hazards of poor hygiene behavior and they can motivate their household members to maintain good hygiene to remain healthy. This is in accordance with the study by Mutalib, Azira[27] that also showed a positive association between age of food handlers and their hygiene practices. Similarly, Schmidt, Aunger[23] in their study found that age of the respondents was positively associated with their hygiene behavior i.e. higher the age of the respondents higher was the adherence to hygiene practices.

Hygiene status and prevalence of diarrhea were significantly associated. Germs that cause diarrhea can be easily transmitted through food, water and contact with dirty surface. Hygiene is the only way to keep diarrhea germs away. Luby, Halder[34] in a study on association of diarrhea and hand washing in Bangladesh started with bivariate analysis which included hand washing

and prevalence of diarrhea and they sequentially added other hygiene behaviors and household characteristics that were related with diarrhea. The bivariate analysis and final multivariate model showed that hygiene practices and household characteristics were significantly associated with prevalence of diarrhea at $p>0.05$. EjemotNwadiaro, Ehiri[35] also found significant association between hygiene practices and prevalence of diarrhea.

CONCLUSION

It is statistically proven that farmer households on average have better hygiene than non-farmer households. In study area, one fourth of the non-farmer households did not have access to toilets and this is an alarming situation. Due to non-availability of toilets, people were forced to defecate in open which has consequences for human health. Majority of the households reported that they dispose their waste water in Naali (an open sewer system). As these open sewer systems serve as means of transportation of germs and bacteria that can cause various diseases including diarrhea, are dangerous for health especially for children, as they use to play near these sewer lines. Same is the case for solid waste, households reported to dump the solid waste in small waste depositories near residences and kids were playing near and even on these depositories which is dangerous for their health. Hygiene status was observed to be associated with education of household head and income. Households heads with better education know the importance of hygiene and the diseases that can be caused by poor hygiene status, so they can motivate their household members to observe and maintain good hygiene practices. Similarly, households with better income can afford good quality toiletries which ensure good hygiene. Also, they can afford to use electronic and social media through which they become aware of the importance of hygiene which acts as a motivating factor to observe good hygiene practices. Farmer households' income was reported to be higher than non-farmer households which explained their better hygiene status and consequently fewer diarrhea incidences. Diarrhea and hygiene status were significantly associated with each other implying that in burden of diarrhea disease can be reduced significantly by maintaining good hygiene practices. It is suggested that hygiene training should be given to the children at schools so that they can stay healthy. Awareness campaigns are necessary to motivate marginalized segments of society to observe good hygiene practices. Also, government should subsidize the construction of toilets at household level in rural areas.

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Each betrayal begins with trust.

– Martin Luther –

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2	Muhammad Iqbal Zafar	Supervised the research and share his expert research opinion.	
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